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SHORT COMMUNICATION

First Record of the Mycoheterotrophic Plant *Gastrodia clausa* (Orchidaceae) from Okinawa Island, Ryukyu Islands, Japan.

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Flowering individuals of a species of *Gastrodia* (Orchidaceae) with a closed perianth tube, a petaloid lip without appendages or calluses, and a column with a large, bifid ventral appendage were discovered in the northern part of Okinawa Island, Okinawa Prefecture, the Ryukyus. This combination of characters is known only in *Gastrodia clausa*, a recently described species from Taiwan. The characteristics of the Okinawan plants agree with the description of *G. clausa*. We therefore conclude that our plants represent the first record of *G. clausa* in Japan.

Key words: *Gastrodia*, mycoheterotroph, new locality, Orchidaceae

Species of *Gastrodia* (Orchidaceae) are mycoheterotrophic orchids distributed in temperate and tropical areas of Madagascar, Asia and Oceania (Chung & Hsu 2006). The genus contains ca. 50 species and is characterized by a fleshy tuber or a coralloid underground stem, the absence of leaves, the union of sepals and petals and two mealy pollinia without caudicles (Pridgeon *et al.* 2005, Chen *et al.* 2009, Cribb *et al.* 2010, Hsu & Kuo 2010, 2011, Suetsugu in press).

Gastrodia shows extraordinary morphological diversity. Some species of section *Gastrodia* (sensu Schlechter 1911), such as *G. elata* Blume, reach 60–100 cm in height during flowering. In contrast, many species of section *Codonanthus* (Schlechter 1911, Tuyama 1967) represented by *G. verrucosa* Blume (the *G. verrucosa* group), have inflorescences only 3–15 cm long at flowering time but 30–40 cm long and with elongated pedicels during fruiting, (Chung & Hsu 2006). Species of the latter group are rarely found during the flowering season, and thus have not been studied intensively (Tuyama 1982, Suetsugu *et al.* 2012). Among Japanese *Gastrodia*, six species belong to section *Codonanthus*: *G. boninensis* Tuyama, *G. confusa* Honda & Tuyama, *G. nipponica* (Honda) Tuyama, *G. pubilabiata* Sawa , *G. takeshimensis* Suetsugu and *G. shimizuana* Tuyama.

During our recent field survey in Okinawa, we discovered *Gastrodia clausa* T. C. Hsu, S. W. Chung & C. M. Kuo (Fig. 1), which was recently described from Taiwan. We thus report its first known occurrence in Japan.

Gastrodia clausa T. C. Hsu, S. W. Chung & C. M. Kuo in Taiwania 57: 271 (2012) —Figs. 1–2

Specimen examined: JAPAN. The Ryukyus. Okina-

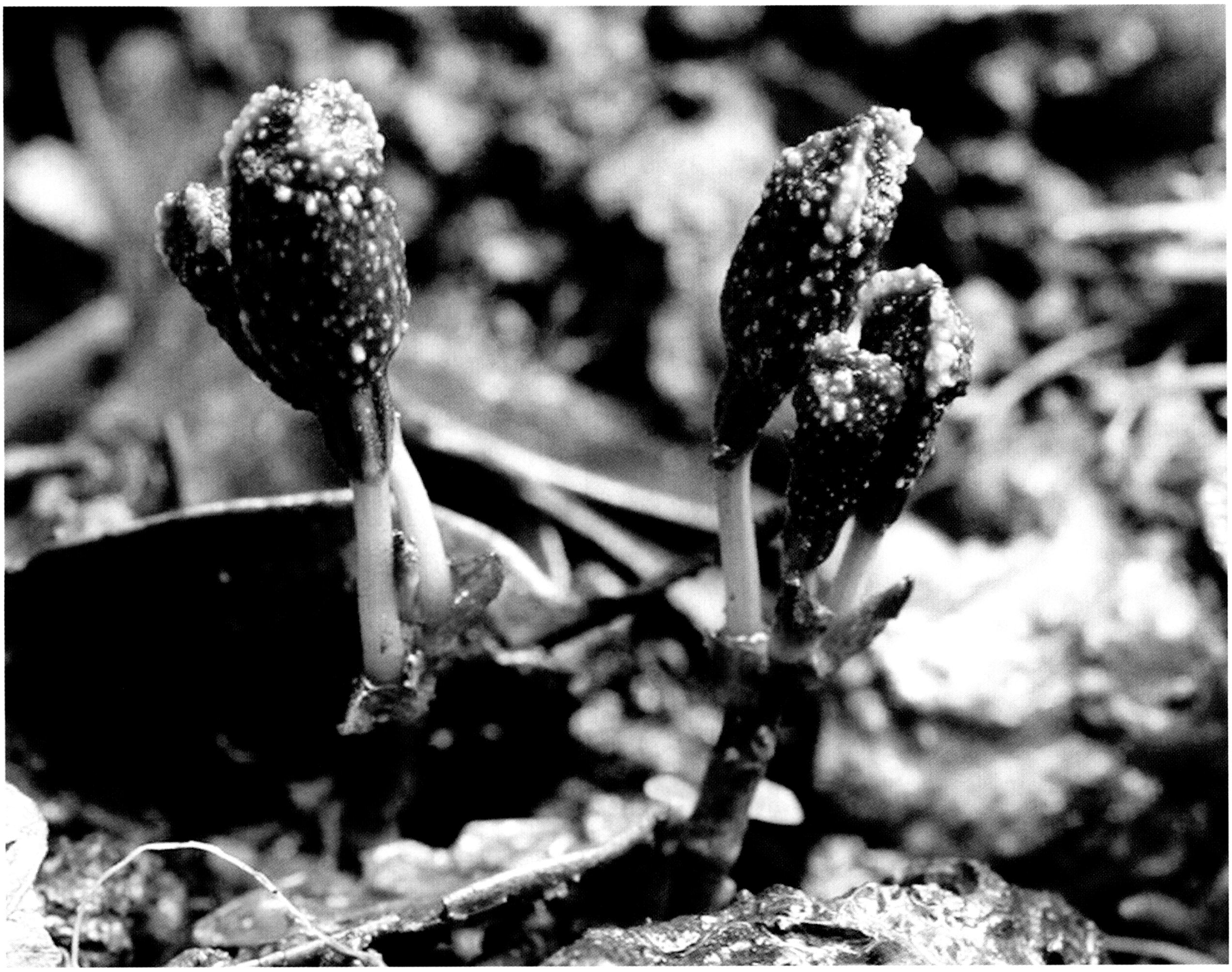

FIG. 1. Flowering plants of *Gastrodia clausa* from Nago City, Okinawa Island, Okinawa Pref., 27 February 2012 (photo by Tazuko Watanabe).

wa Pref., Okinawa Island, Nago City. 2 March 2012, *M. Nakama s.n.* (KYO)

Herbs, terrestrial, mycoheterotrophic. Rhizome tuberous, fusiform or cylindrical, 2–7 cm long, 3–9 mm in diameter, brown, covered with numerous scales and root-hair-like unicellular hairs. Stem erect, slender, pale brown, 3–5 cm tall, 2–3 mm in diameter; floral bracts widely ovate to ovate, brown, 5–6 × 3–5 mm. Pedicel with ovary 5–10 mm long. Flowers 1–5, tubular, deep brown; tepals connate and forming a 6-lobed perianth tube; perianth tube entirely closed, 5–6 mm in diameter. Sepals similar, 10–12 mm long, connate with petals and lip 3/5–2/3 their length, outer surface densely verrucose, inner surface smooth, margins entire, apex slightly concave; free portion of dorsal sepal broadly ovate, 3.5–4 × 4.5–6 mm; free portion of lateral sepals deltoid, 4–5 × 4–5 mm. Petals brown, ovate-deltoid; free lobes 3 × 3 mm, base contracted, margin entire. Lip adnate to perianth tube, brown, ovate-deltoid, 3 × 3 mm, base contracted, margin entire. Column straight, clavate, 6 × 2.8 mm, white tinged grayish brown at base, with a pair of lateral wings and a prominent ventral appendage; column foot obscure; lateral wings, red, incurved, edges parallel to column, rostellum absent; stigma slightly below middle of column; ventral appendage red, arising just below stigma, apex parallel to column, rhombic-ovate, 3 × 2.5 mm, bilobed at apex. Anther hemispheric, 1 × 0.8 mm in diameter. Pollinia 2, granular-farinaceous, composed of many separable masses, without caudicle and viscidium. Capsule cylindrical, 2–3 cm long; pedicel to 15–40 cm long in fruit.

Japanese name: Tsubomi-yatsushiro-ran, nov.

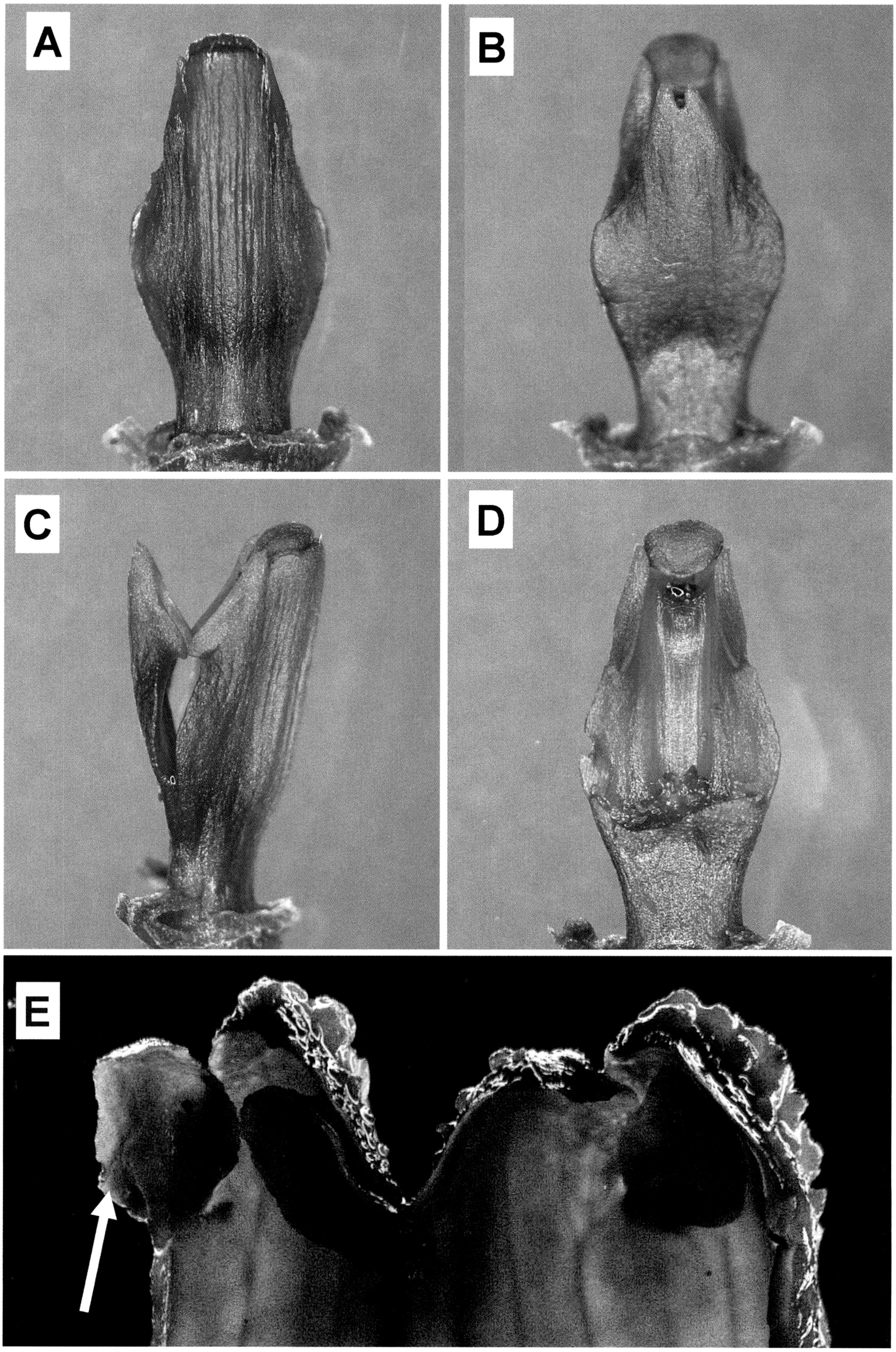

FIG. 2. Floral structure of *Gastrodia clausa*. Column morphology of *G. clausa* (A–D), dorsal view (A), ventral view (B), side view (C), ventral view, ventral appendage removed (D). Expended and flattened perianth tube (E). Arrow indicates petaloid lip.

Notes: The plants we found of *Gastrodia* have three conspicuous characteristics: a closed perianth tube, a petaloid lip joined with the perianth tube and a column with a large, bifid ventral appendage (Figs. 1–2). These features have never been recorded in any known species of *Gastrodia* in Japan. Within section *Codonanthus*, the aforementioned characters are known to occur only in *Gastrodia clausa*, a recently described species from Taiwan (Hsu *et al.* 2012). The characteristics of the Okinawan plants agree with description of *G. clausa*. We therefore conclude that this is the first discovery of *G. clausa* in Japan. As currently known, the distribution of *Gastrodia clausa* is restricted to only one population on Okinawa Island. The population is in a dense forest dominated by *Distylium racemosum* Siebold & Zucc., *Elaeocarpus zollingeri* K.Koch and *Psychotria manillensis* Bartl. ex DC. Dozens of individuals have been found, all within an area of less than 100 m^2 at an elevation of ca. 350 m.

The flowers of *Gastrodia clausa* remained closed throughout the flowering period (late February to early March) and, as reported by Hsu *et al.* (2012), the pollinia rapidly fragment into massulae before the flowers mature. The massulae then automatically drop onto the stigma surface. The species have therefore an obligate self-pollination system. We also observed in the field that the pedicels elongate considerably (late March to mid April) until the dehiscence of the capsules. This feature is commonly reported in species of section *Codonanthus* and is theorized to facilitate seed dispersal by wind (Pedersen *et al.* 2004).

Our discovery of *G. clausa* is not totally unexpected, since it has mostly been recorded from northern Taiwan (Hsu *et al.* 2012), not far from the Ryukyu Islands. Plants of section *Codonanthus* are small and relatively difficult to find during the flowering season, making it possible to mistake *G. clausa* and other species for more common species of *Gastrodia* with similar phenology, such as *G. nipponica* (Suetsugu *et al.* 2012). Extensive surveys during the flowering season are needed to determine the precise distribution of species in section *Codonanthus* in the Ryukyus.

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